

FIG.1

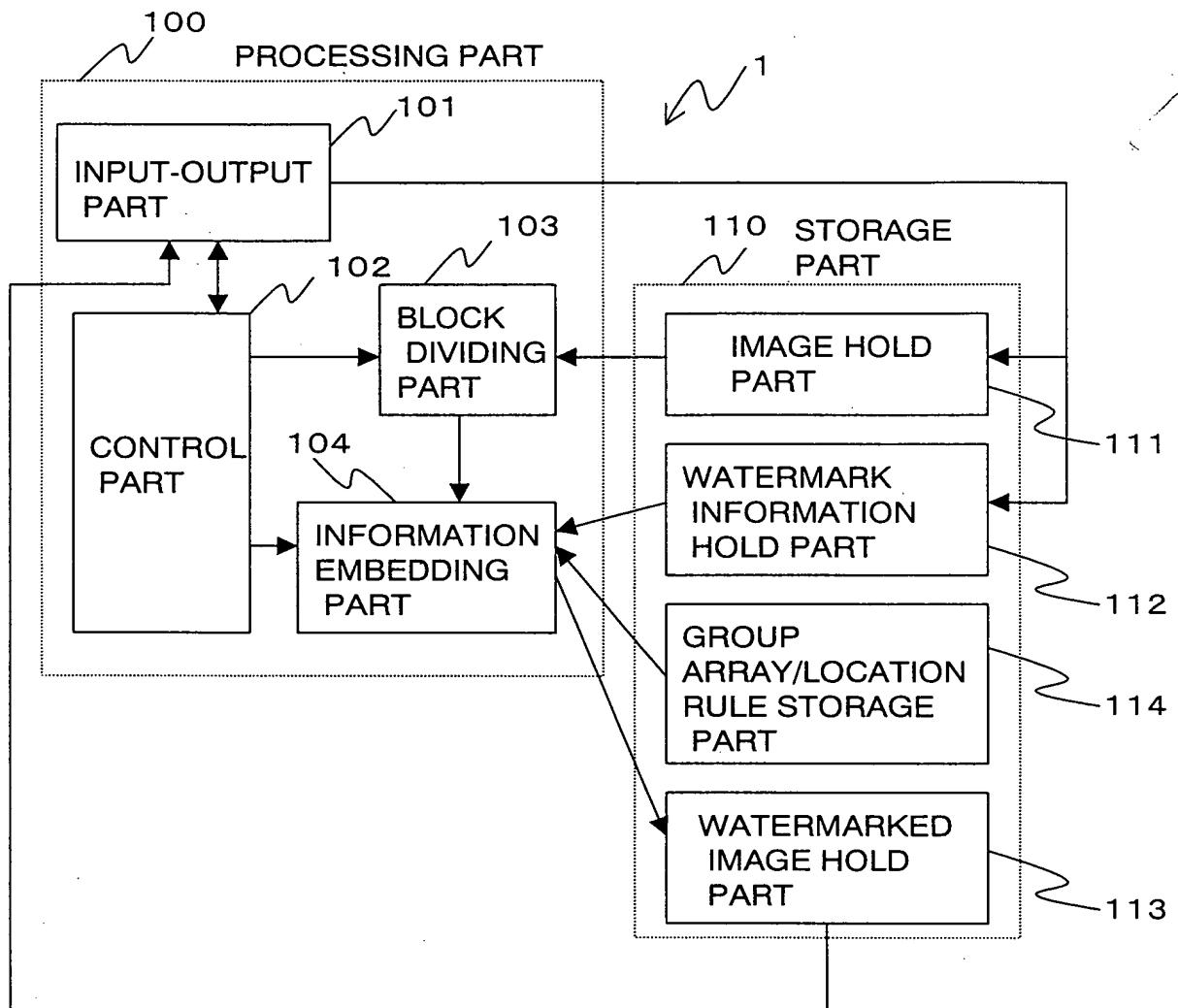


FIG.2

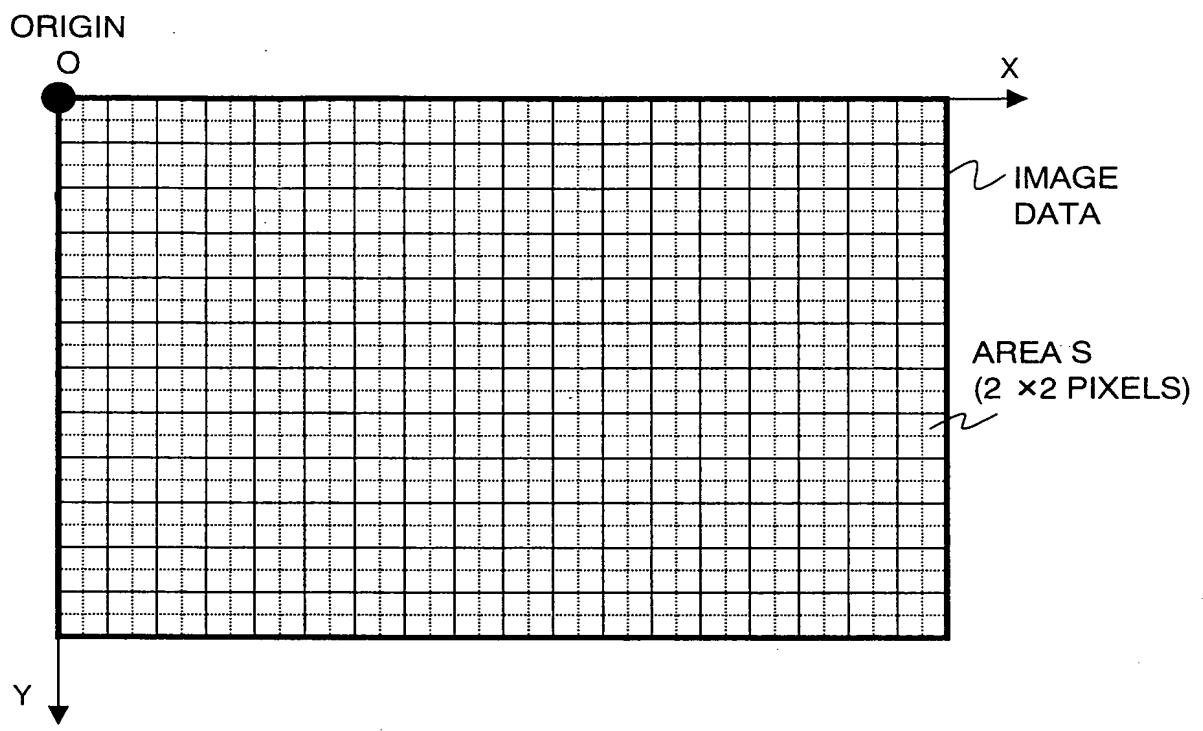


FIG.3

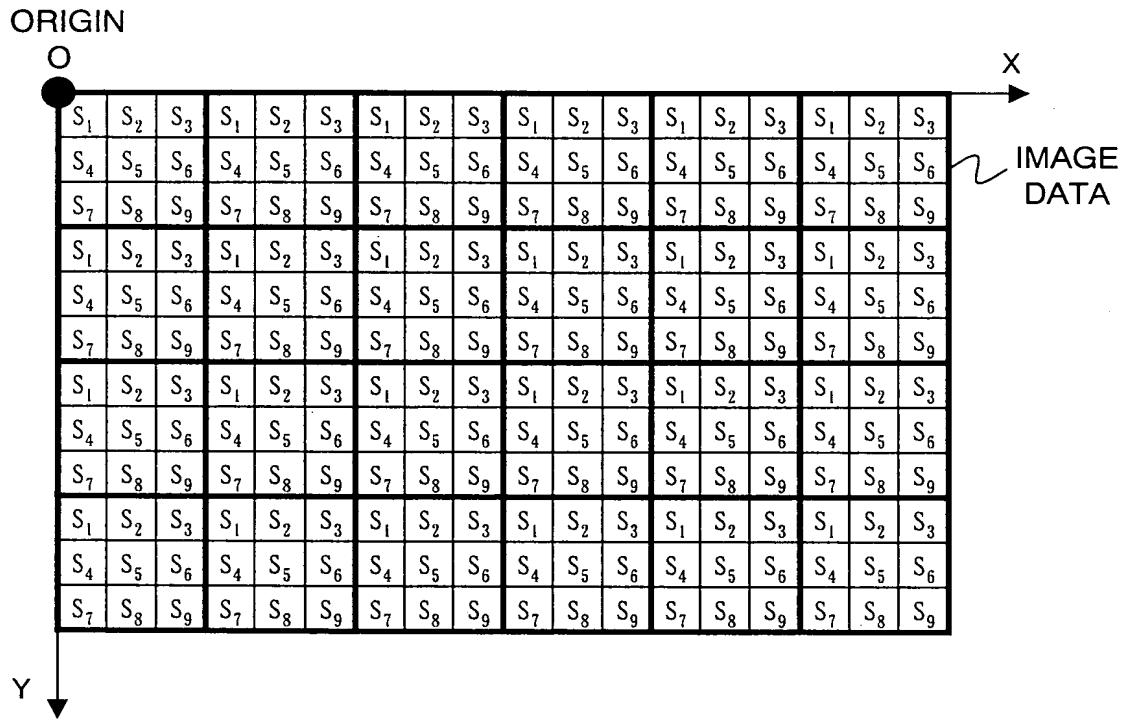


FIG.4

FIRST PATTERN

S_1	S_2	S_3
↑	↑	↑
S_4	S_5	S_6
↑	↑	↑
S_7	S_8	S_9
↑	↑	↑

GROUP G

SECOND PATTERN

S_1	S_2	S_3
↑	↓	↑
S_4	S_5	S_6
↓	↑	↓
S_7	S_8	S_9
↑	↓	↑

GROUP G

↑ FOR A BIT 1, BRIGHTNESS IS INCREASED.
 ↓ FOR A BIT 0, BRIGHTNESS IS DECREASED.

↓ FOR A BIT 1, BRIGHTNESS IS DECREASED.
 ↑ FOR A BIT 0, BRIGHTNESS IS INCREASED.

FIG.5

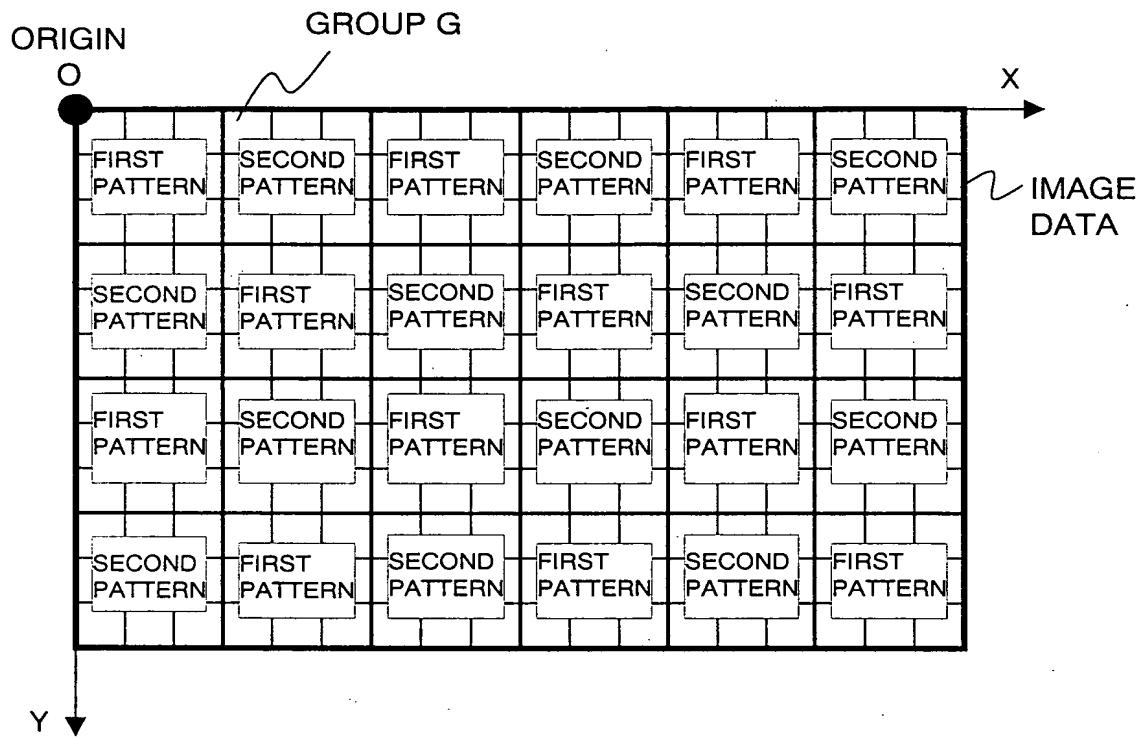


FIG.6

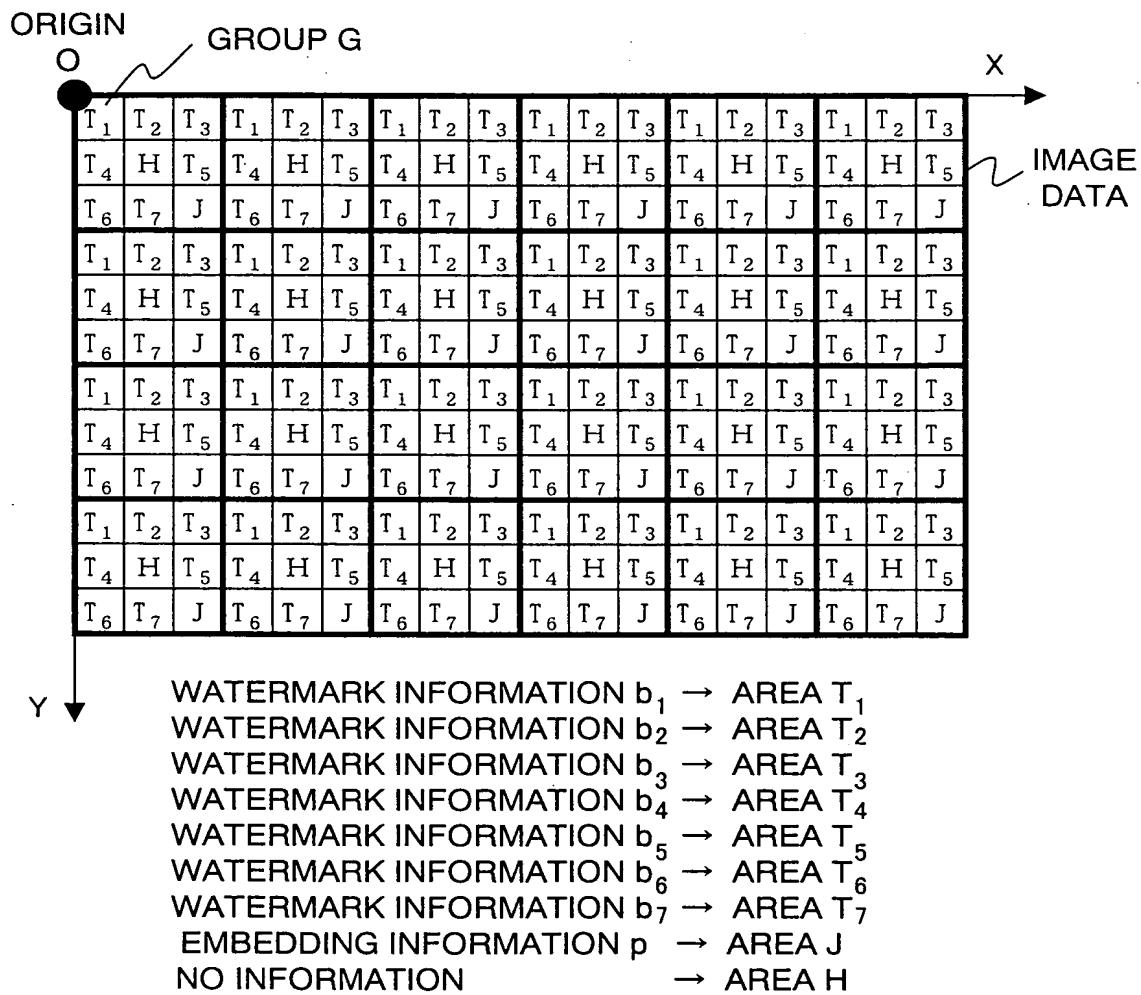


FIG.7

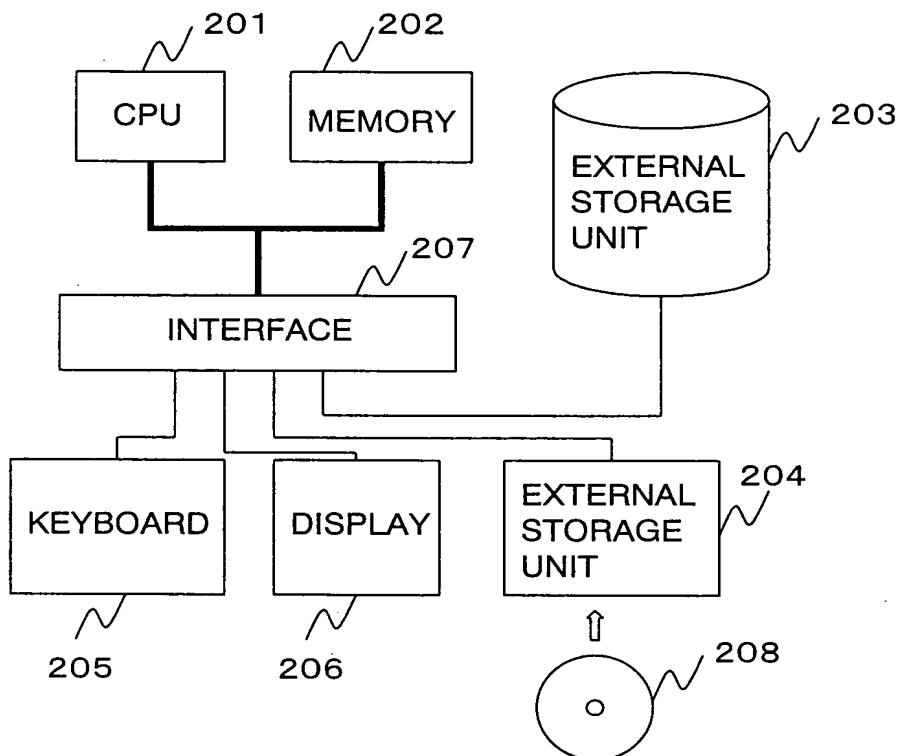


FIG.8

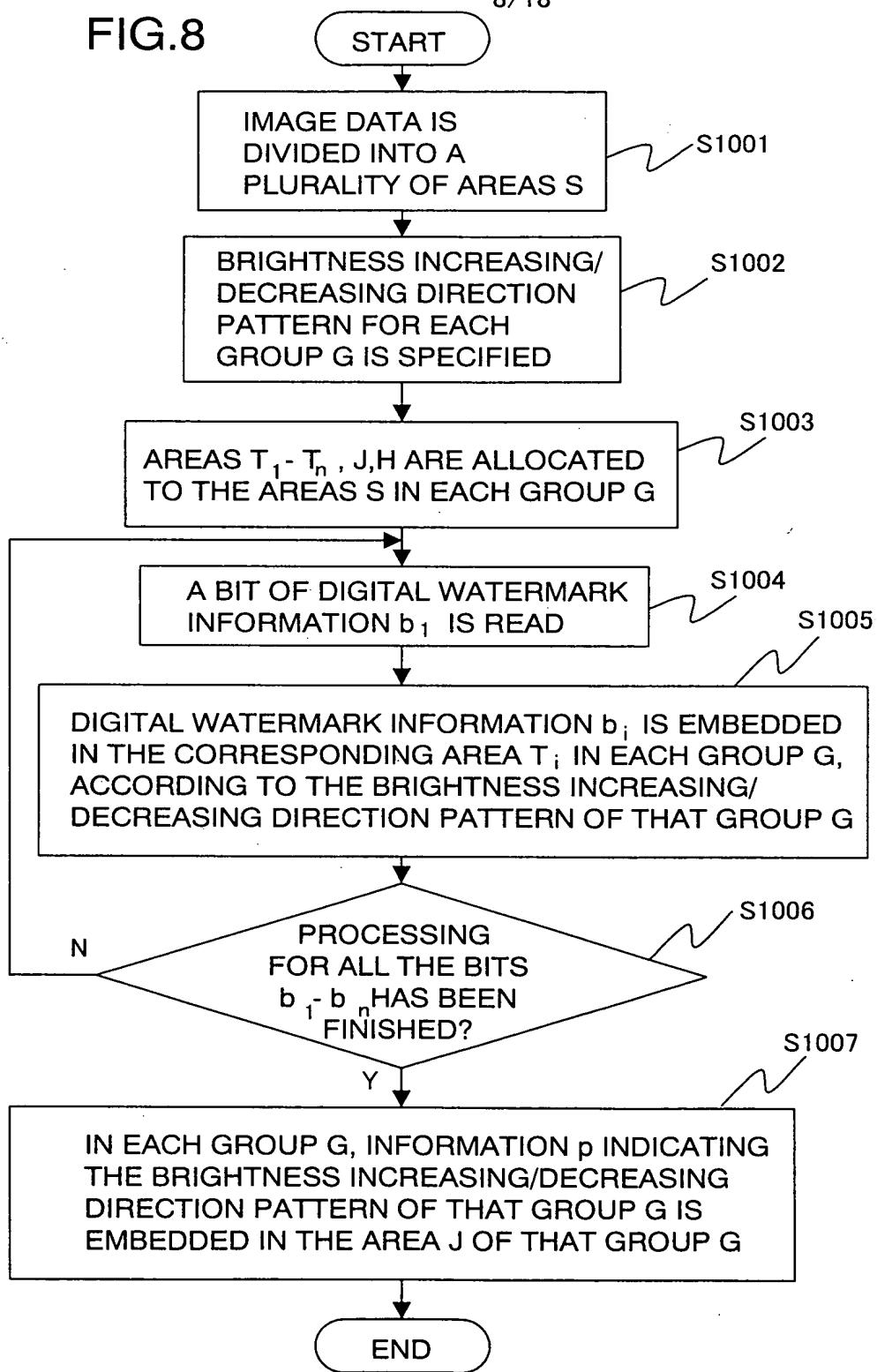
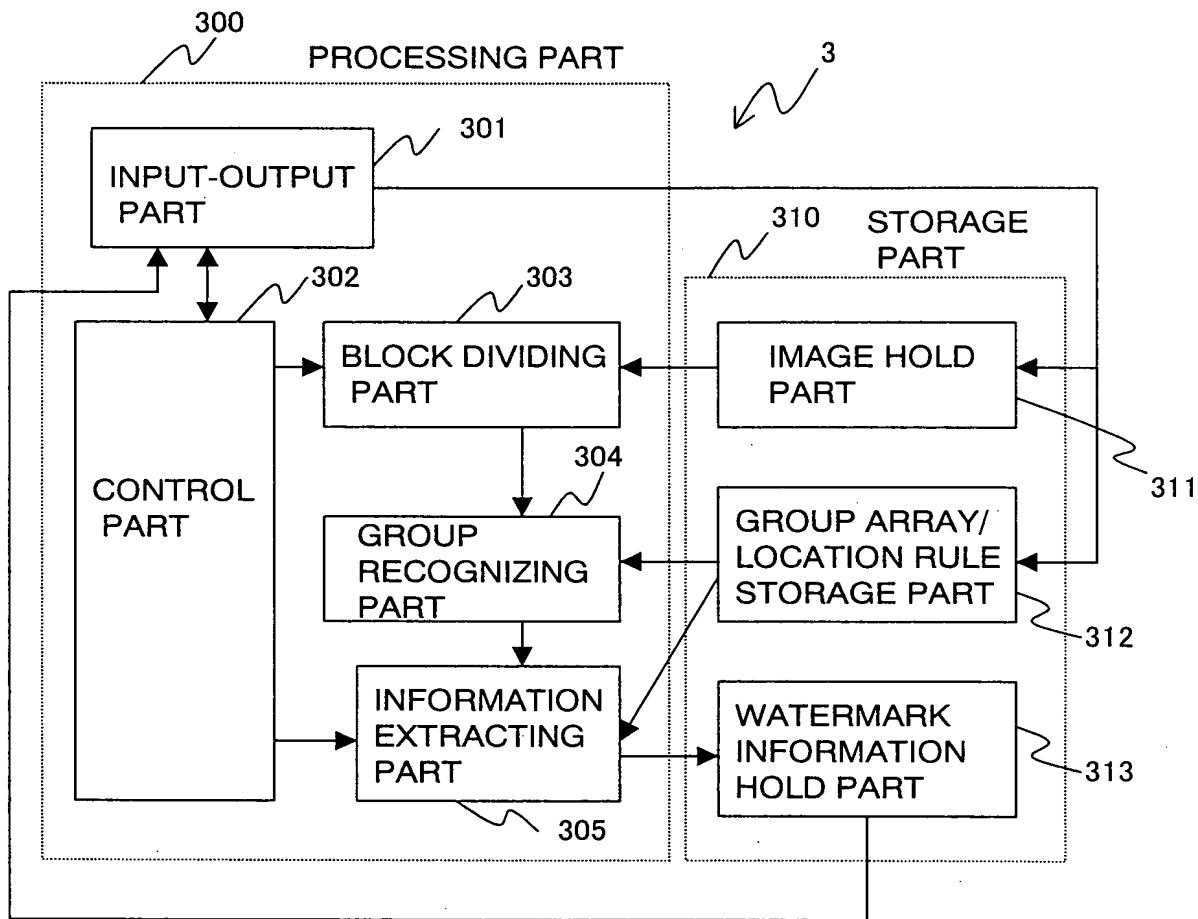


FIG.9



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FIG.10

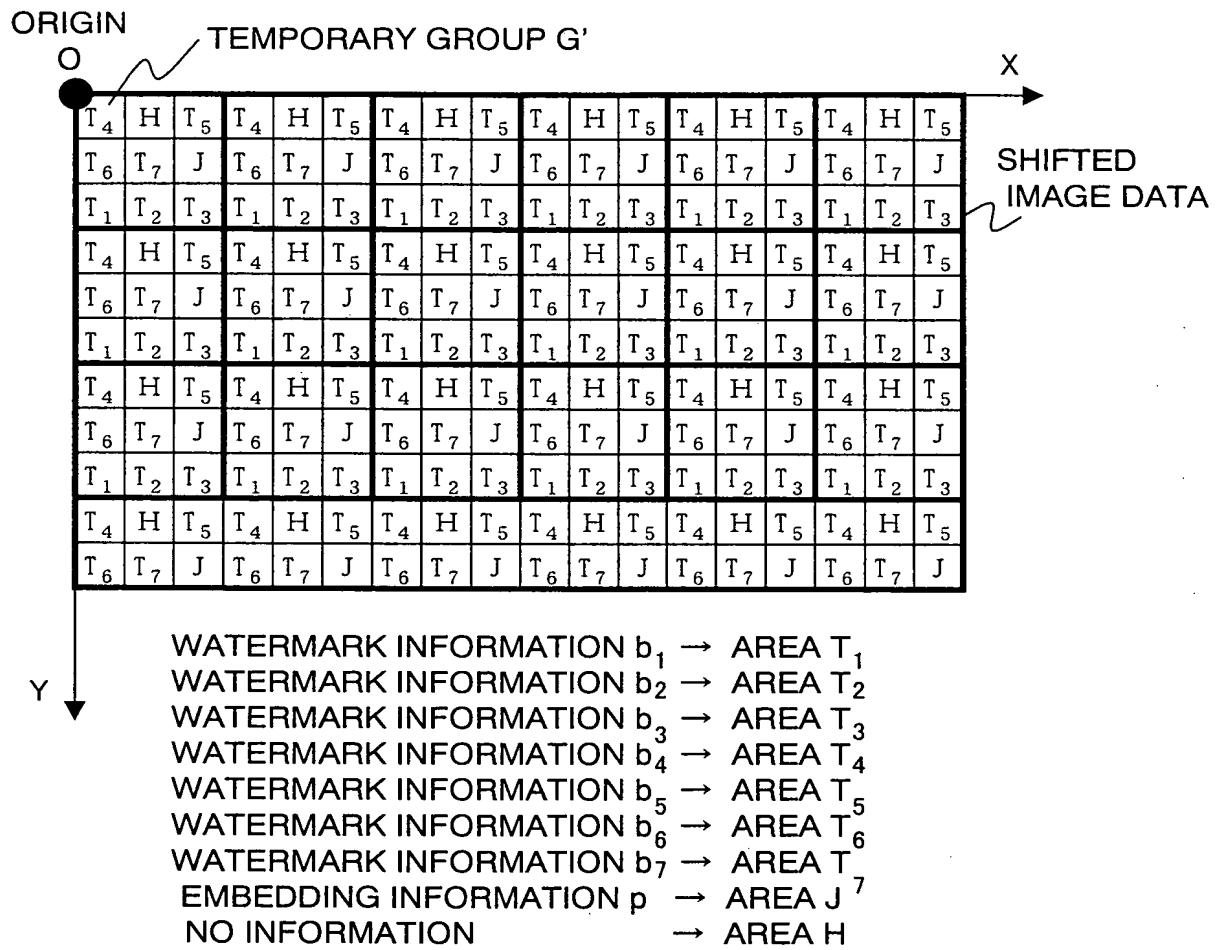


FIG.11

ORIGIN

O

T ₄	H	T ₅															
T ₆	T ₇	J															
T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
T ₄	H	T ₅															
T ₆	T ₇	J															
T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
T ₄	H	T ₅															
T ₆	T ₇	J															
T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
T ₄	H	T ₅															
T ₆	T ₇	J															
T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃	T ₁	T ₂	T ₃
T ₄	H	T ₅															
T ₆	T ₇	J															

X

SHIFTED
IMAGE DATA

GROUP G

Y

WATERMARK INFORMATION b₁ → AREA T₁
 WATERMARK INFORMATION b₂ → AREA T₂
 WATERMARK INFORMATION b₃ → AREA T₃
 WATERMARK INFORMATION b₄ → AREA T₄
 WATERMARK INFORMATION b₅ → AREA T₅
 WATERMARK INFORMATION b₆ → AREA T₆
 WATERMARK INFORMATION b₇ → AREA T₇
 EMBEDDING INFORMATION p → AREA J
 NO INFORMATION → AREA H

FIG.12

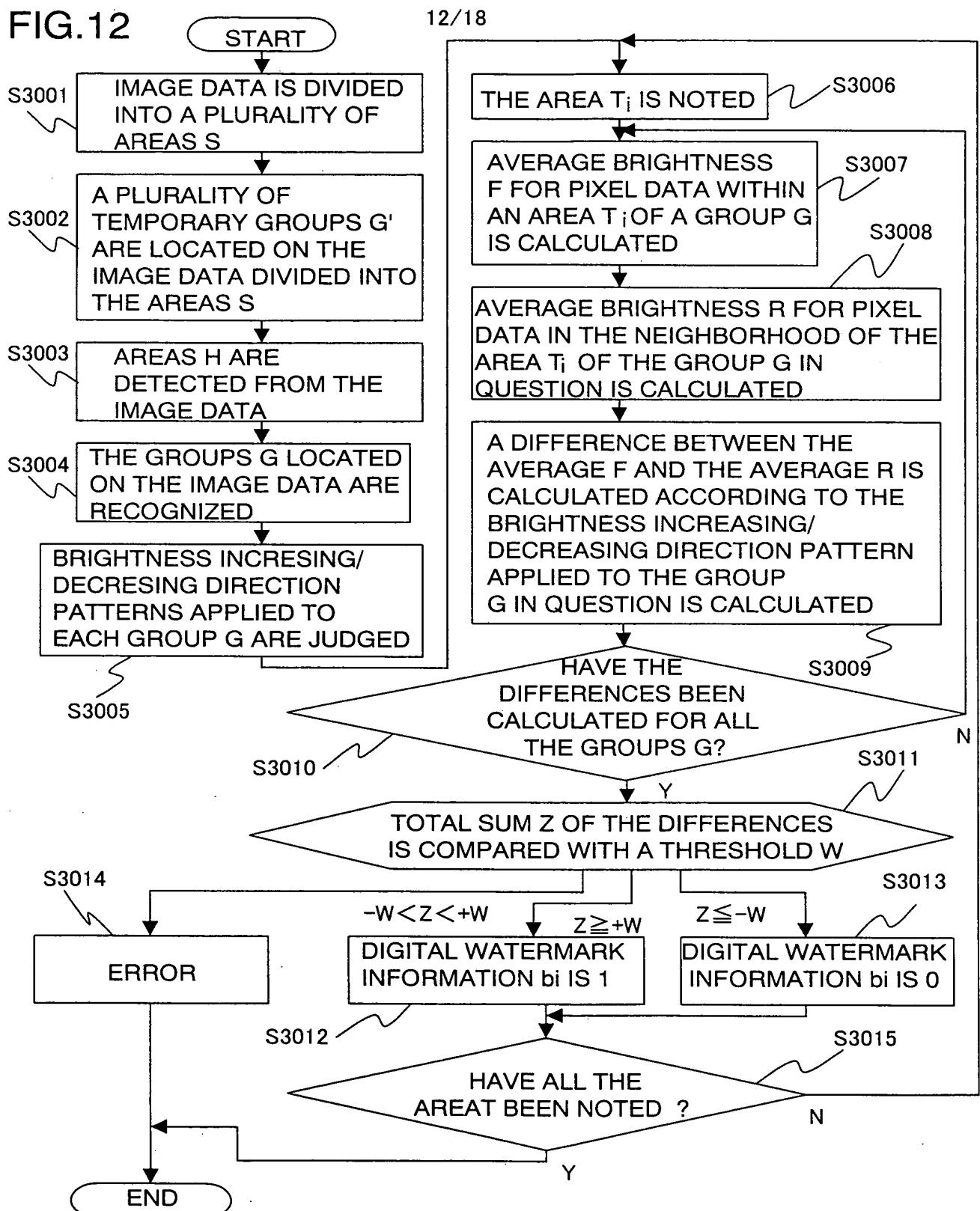


FIG.13A

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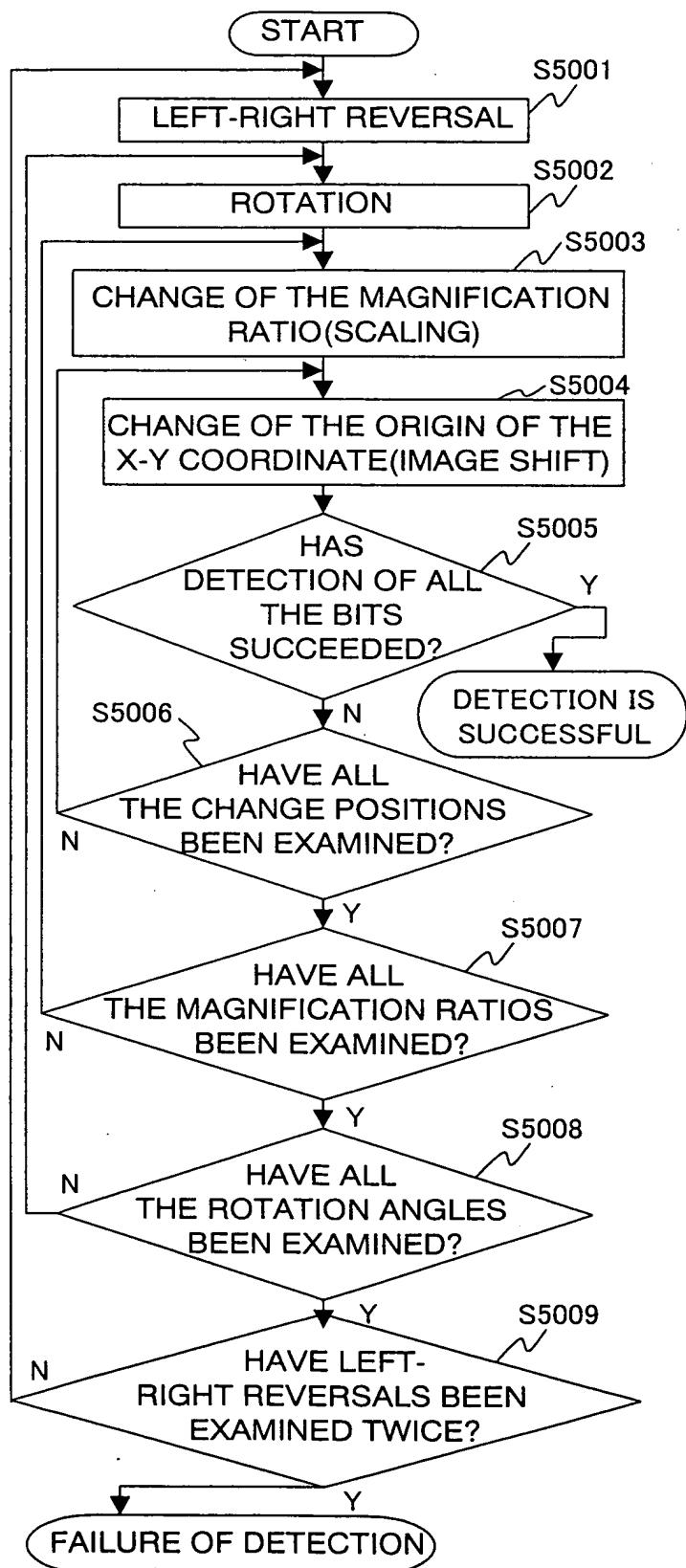


FIG.13B

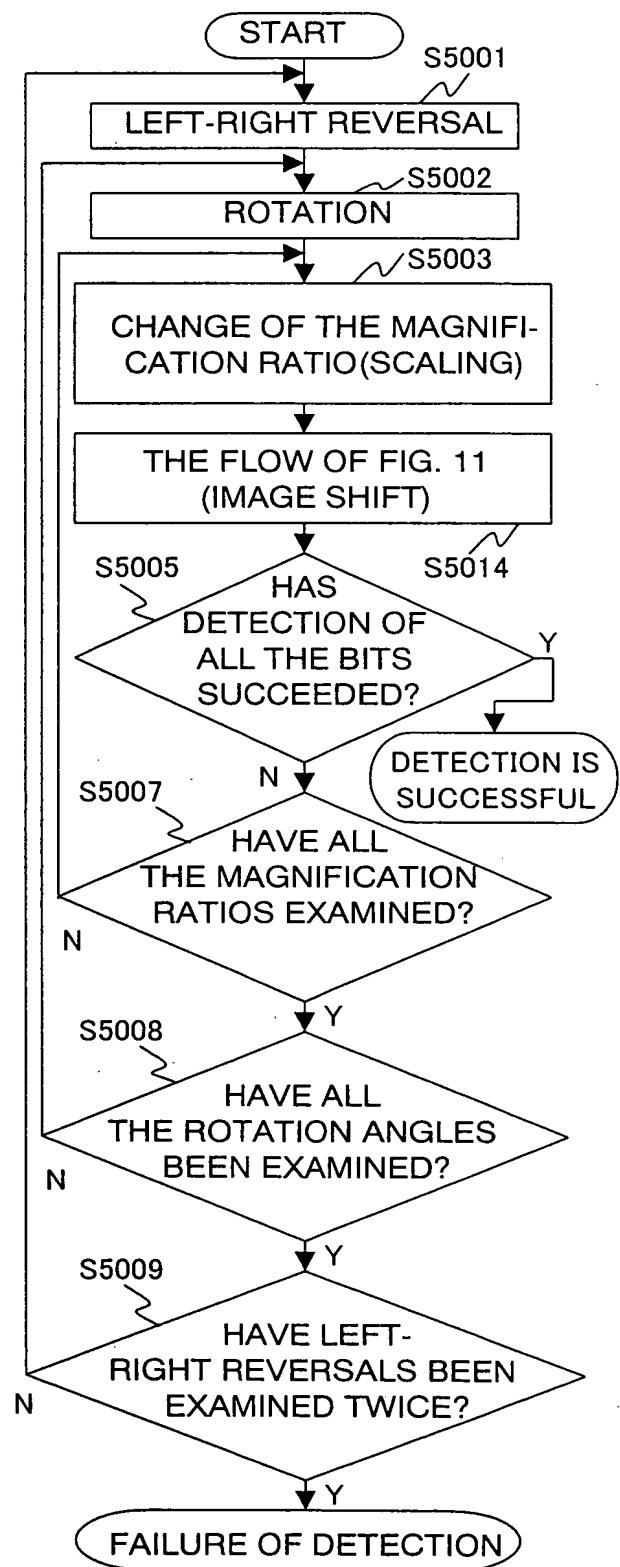


FIG.14

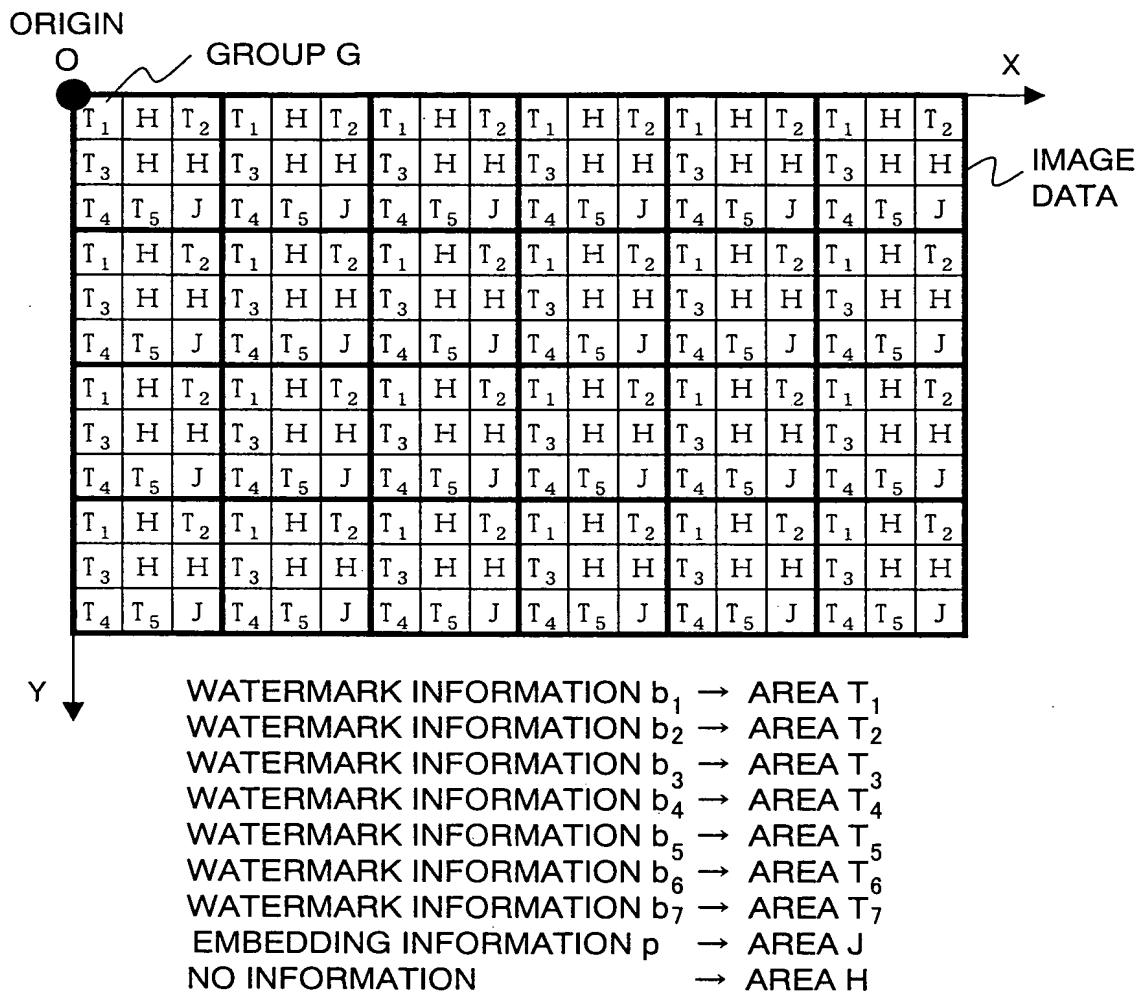


FIG.15

ORIGIN

O GROUP G

T ₂	H	T ₁															
H	H	T ₃															
J	T ₅	T ₄															
T ₂	H	T ₁															
H	H	T ₃															
J	T ₅	T ₄															
T ₂	H	T ₁															
H	H	T ₃															
J	T ₅	T ₄															
T ₂	H	T ₁															
H	H	T ₃															
J	T ₅	T ₄															
T ₂	H	T ₁															
H	H	T ₃															
J	T ₅	T ₄															
J	T ₅	T ₄															

X

LEFT-RIGHT-
REVERSED
IMAGE DATA

Y

WATERMARK INFORMATION b₁ → AREA T₁
 WATERMARK INFORMATION b₂ → AREA T₂
 WATERMARK INFORMATION b₃ → AREA T₃
 WATERMARK INFORMATION b₄ → AREA T₄
 WATERMARK INFORMATION b₅ → AREA T₅
 WATERMARK INFORMATION b₆ → AREA T₆
 WATERMARK INFORMATION b₇ → AREA T₇
 EMBEDDING INFORMATION p → AREA J
 NO INFORMATION → AREA H

FIG.16

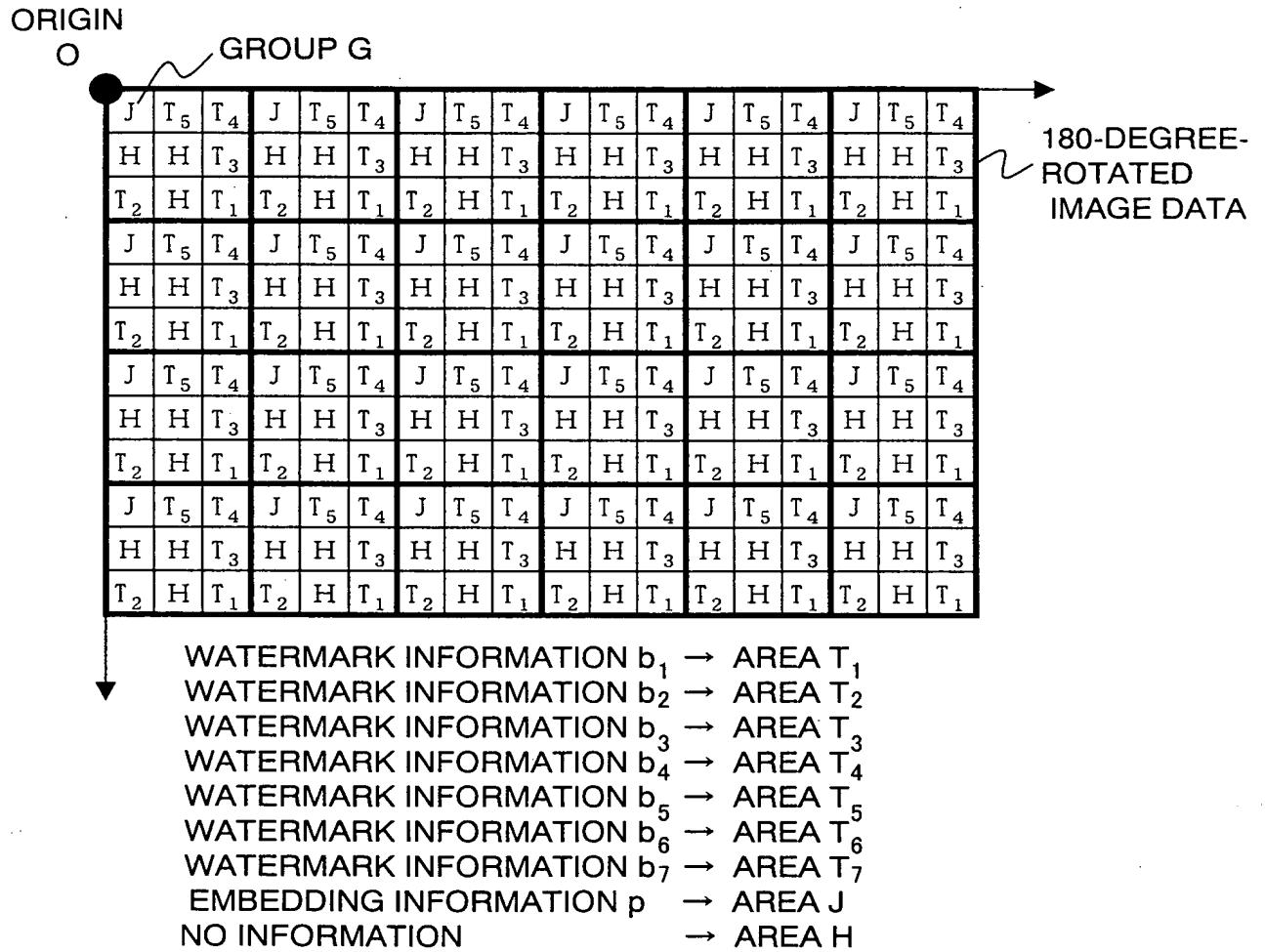
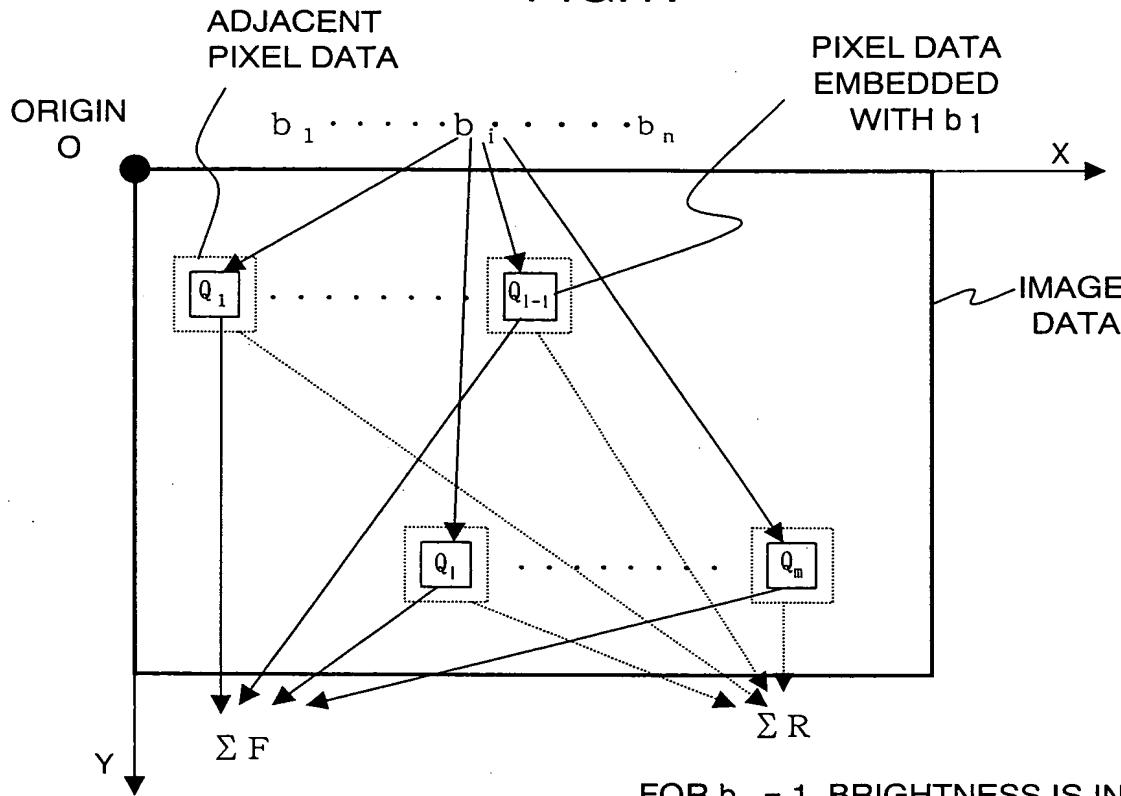


FIG.17



FOR $b_i = 1$, BRIGHTNESS IS INCREASED
FOR $b_i = 0$, BRIGHTNESS IS DECREASED

JUDGEMENT : $\Sigma F - \Sigma R \geq Th \rightarrow b_i = 1$

$\Sigma F - \Sigma R \leq -Th \rightarrow b_i = 0$

$-Th < \Sigma F - \Sigma R < Th \rightarrow$ WATERMARK IS NOT EMBEDDED
(WHERE Th IS A POSITIVE THRESHOLD)

FIG.18

